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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2005/003693 filed 04/08/2005, and published on 10/27/2005 as WO 2005/101938 A1, and of eight (8) amended claims.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Mounting Plate for Electronic Components

The invention relates to a mounting plate for electronic components, having coolant lines integrated in a plate body for a cooling fluid to flow through, wherein a fastening arrangement for mounting electronic components to be cooled is arranged on the plate body.

From the prior art it is known to install cooling coils in a mounting plate or mounting board for cooling electronic devices, for example frequency converters, which are to be mounted on the mounting plate. The waste heat from the electronic components can be removed by means of a so-called "cold plate".

The electronic components can be held on such a known mounting plate by means of screw connections. Screw holes are provided for this purpose in the housings of the electronic components, through which a screw can be screwed into threaded holes to be cut into the mounting plate. However, holes cannot be cut into the known mounting plates without the danger of damage to the cooling coils. Furthermore, the electronic components often have varied dimensions, so that different fastening dimensions also exist. It is therefore often not possible to provide the mounting plate with a prefabricated grid of threaded holes, because the threaded holes arranged on the housings of the electronic components are not aligned with the former.

In connection with known mounting plates of the PADA Engineering company, the cooling coils are placed so they are visible from the plate surface in order to prevent accidental damage of the coolant conduits during the subsequent mechanical processing of the mounting plate in this way.

However, it is necessary in connection with the known mounting plates to cut specially arranged threaded bores, depending on the fastening dimensions of the electronic components to be mounted. This is expensive from the viewpoint of manufacturing technology.

The packing density of several electronic components to be mounted is also reduced by the mounting areas prescribed by the position of the cooling coils, since not every location is suitable for drilling a threaded hole because of the layout of the coolant lines.

It is the object of the invention to disclose a mounting plate for electronic components which, along with a reduced mounting outlay, assures the secure holding of electronic components to be mounted, and dependably prevents the danger of damage to the coolant lines. In addition, the mounting plate in accordance with the invention is intended to make possible the greatest possible packing density of the electronic components.

This object of the invention is attained by means of the characteristics of claim 1. Advantageous further embodiments are described in the respective dependent claims.

Accordingly, the fastening arrangement has at least one first groove, which is embodied to be C-shaped in cross section and extends in a straight line in the extension direction of the mounting plate, into which at least one screw nut for forming a screw connection with an electronic component can be inserted in a manner fixed against relative rotation. The additional cutting of threaded holes is avoided by means of this arrangement. Mounting can be simply performed, wherein the matching to the structural conditions of the component housings is possible because of the

arbitrarily possible positioning of the screw nut.

In accordance with a further basic consideration, the fastening arrangement can have at least one second groove, which is designed identically to the first groove and extends parallel with the first groove, whose distance from the first groove is substantially determined by the length of extension perpendicularly in respect to the first and second grooves of the electronic component to be mounted. It is assured by means of this that, with a preset fastening dimension of electronic components to be mounted, simple securing on the mounting plate can take place.

In accordance with an advantageous further development, the fastening arrangement can have a further groove, which is embodied identically to the first and second grooves and extends parallel with the second groove and which extends at the side of the second groove facing away from the electronic component to be mounted at a distance from the latter which is less than the distance between the first groove and the second groove. With this arrangement an additionally used further fastening dimension of electronic components to be mounted is taken into account.

Electronic components can be mounted in a simple manner, which have screw holes whose distance from each other corresponds to the distance of the second groove from the first groove, or that of the still further groove from the second groove. In this way the electronic components can be directly fastened by means of screws in the screw nuts inserted into the grooves.

However, in case the fastening dimensions of the electronic components to be mounted do not agree with the distances between the parallel extending grooves, i.e. if the

electronic components to be mounted have screw holes whose distance from each other is less than the distance of the second groove from the first groove, or less than the distance of the still further groove from the first groove, the component can be fixed in place at least on one side by means of an angle bracket, wherein at least one screw engaging the angle bracket is screwed into the screw nut introduced into the respective groove.

Here, the angle bracket can have a level base plate for placement against the mounting plate and a clamping area angled off in respect to it for the clamping fixation of the electronic component to be mounted. In this case the clamping area can clampingly act on a protrusion provided on the electronic component.

For achieving a particularly simple matching to different fastening dimensions of electronic components to be mounted, the angle bracket can have at least one elongated hole extending perpendicularly in respect to the extension direction of the second groove or of the still further groove for receiving the screw.

In an advantageous embodiment the screw nut can be a spring nut.

In regard to manufacturing technology it can be advantageous if the first groove, the second groove and/or the still further groove are made of one piece with the plate body.

The invention will be explained in greater detail in what follows by means of a preferred embodiment while making reference to the attached drawings.

Shown are in:

Fig. 1, in a schematic and perspective lateral view a

mounting plate without electronic components to be mounted on it and to be cooled,

Fig. 2, in a schematic and perspective lateral view an angle bracket for mounting, which can be matched to various fastening dimensions, of electronic components to be mounted, and

Fig. 3, in a schematic and perspective lateral view the mounting plate in accordance with Fig. 1 with electronic components to be mounted on it and to be cooled, each of which is clampingly held on one side by an angle bracket in accordance with Fig. 2.

In a schematic and perspective lateral view, Fig. 1 shows a mounting plate 10 without electronic components to be mounted on it and to be cooled. The mounting plate 10 has a level plate body 14 made of aluminum, in which a coolant line with connectors 16 and 18 in the form of a cooling coil, not visible, is formed for coolant to flow through. In the area into which the coolant coil has been integrally placed, the plate body 14 has not been additionally machined and is shaped flat and level. On the right side in Fig. 1 of the area into which the coolant coil has been integrally placed, a first groove 20, which is embodied to be approximately C-shaped in cross section and extends straight in the extension direction (arrow A) of the mounting plate 10, has been formed in one piece with the plate body. At least one spring nut (not represented) for forming a screw connection with an electronic component can be introduced, fixed against relative rotation, into the first groove 20. The electronic components to be attached can then be screwed together with the nut.

A second groove 22 extends parallel with the first

groove 20 on the side of the plate body at the left in Fig. 1, into which the coolant coil has been integrally placed. The distance B between the first groove 20 and the second groove is determined for one by the area of the plate body into which the coolant coil has been integrally placed, and furthermore by the extension length, running perpendicularly in respect to the first groove 20 and the second groove 22, of an electronic component.

A further groove 24 extends parallel with the first groove 20 and the second groove 22, which extends on the side 26 of the second groove facing away from the electronic component to be mounted at a distance C to the second groove. The distance C is less than the distance B between the first groove 20 and the second groove 22 and is matched to a different fastening dimension than that of the second groove 22.

Electronic components to be mounted, whose housing has screw holes whose distance corresponds to the distance B of the second groove 22 from the first groove 20, or of the still further groove 24 from the first groove 20, can be directly fastened by means of screws in the screw nuts inserted into the grooves 20, 22, 24.

In a schematic and perspective lateral view, Fig. 2 shows an angle bracket 30 for mounting, which can be matched to various fastening dimensions of electronic components to be mounted.

Electronic components to be mounted, whose housings have screw holes whose distance from each other is less than the distance B (represented in Fig. 1) of the second groove 22 from the first groove 20, or less than the distance of the still further groove 24 from the first groove 20, can be

clampingly fixed in place at least on one side by the angle bracket 30 by means of at least one screw (not represented) engaging the screw nut introduced into the appropriate groove 22.

The angle bracket 30 has a level base plate 34 for placement against the mounting plate 10 and a clamping area 36, angled off it and made in one piece, for the clamping fixation in place of the electronic component to be mounted.

The angle bracket 30 has two elongated holes 38 and 39 extending perpendicularly (arrow D) to the extension direction (arrow A) of the second groove 22 or the still further groove 24 for receiving a screw (not represented).

In a schematic and perspective lateral view, Fig. 3 shows the mounting plate 10 in accordance with Fig. 1 with frequency converters 12 to be mounted on it and to be cooled, each of which is clampingly held on one side by an angle bracket 30 in accordance with Fig. 2.

The frequency converters, whose extension B does not match the spacing between the two grooves 20 and 22, are each screwed together on the side on the right in Fig. 3 with screws engaging the spring nuts (not represented) introduced into the groove 20. Such a screw has been provided the reference numeral 28 in Fig. 3.

On the left side in Fig. 3, the frequency converters 12 are each clamped to an additional angle bracket, one of which has been provided with the reference numeral 30. For example, a screw 32 in the elongated hole 38 of the angle bracket 30 represented, engages a spring nut (not represented) introduced into the second groove 22. The angle bracket 30 clampingly engages a protrusion 13 on the housing of the frequency converter 12. The fastening dimension which

does not match the groove distances is compensated by means of the elongated hole.